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where $\alpha, \beta, \gamma, \dots$ are the six different prime factors 2, 3, 5, 7, 31, 61 (with repetition 2 and 5) combined in products of 1, 2, 3, ..., 10 letters at a time.

By actual calculation and checking we have found the following ten solutions:

$$\begin{aligned}x &= -3343, 12721, 320, 305, 7547, -2225, -710, -3215, -8495, -56950; \\y &= 2, 8, 29, 374, 4187, -1, -91, -1486, -4276, -29851; \\u &= 568, -2634, -116, 454, 5923, +337, -126, -2136, -6102, -42446; \\v &= -137, -89, -101, 319, 5473, -141, -261, -2121, -5841, -39941.\end{aligned}$$

Also solved by G. B. M. Zerr.

169. Proposed by R. D. CARMICHAEL, Princeton University.

Let $Q_n(x)=0$ be the equation whose roots are all the primitive n th roots of unity without repetition. In $Q_n(x)=0$ replace x by α/β , a fraction in its lowest terms, and clear of fractions. Let $Q_n(\alpha, \beta)$ represent the resulting first member. Set $n=mp$ where p is the largest prime factor of n . It is required to find all the integral values of α, β, m, p satisfying the following relations:

$$\begin{aligned}(1) \quad & Q_m p(\alpha, \beta) = p, \\(2) \quad & \alpha^m - \beta^m \equiv 0 \pmod{p}.\end{aligned}$$

One such solution is: $\alpha=2, \beta=1, m=2, p=3$. (See MONTHLY, Vol. XII, p. 89.)

[No solution of this problem has been received.]

170. Proposed by PATRICK WALSH, 1451 Annunciation Street, New Orleans, La.

The areas of rectangles A and B are respectively $15170 \frac{10}{27}$ and 31230.3627 . Find the sides and diagonal of each rectangle in exact or rational numbers.

Solution by B. F. FINKEL, Ph. D.

For A , let x and y be the dimensions of the field. Then

$$xy = 15170 \frac{10}{27} = \frac{2^{14} \cdot 5^2}{3^3} \dots (1), \text{ and } \sqrt{x^2 + y^2} = d \dots (2),$$

where d is the diagonal, which is to be rational. Solving (1) for y and substituting the value thus found in (2) and reducing, we have

$$\sqrt{\frac{3^6 x^4 + 2^{28} \cdot 5^4}{3^3 y}} = d.$$

Let $x = \frac{2^7 \cdot 5}{3^2} z$. Then $d = \frac{2^7 \cdot 5}{3^2 z} \sqrt{z^4 + 9}$. Let $\sqrt{z^4 + 9} = z^2 t - 3$. Then

$$z^2 = \frac{6t}{t^2 - 1}.$$